1212458

Meeting Notes: Retrieval Completion Certification per the Consent Decree

Meeting Date: March 6, 2012, 1:00 pm

Location: 2440 Stevens Center, room 2664

Purpose: Continue discussion of the Consent Decree requirement for a written certification that DOE has completed retrieval of a tank and the practicability evaluation to forego a third technology.

Attendees: Jeff Lyon, Ecology, Nancy Uziemblo, Ecology, Mike Barnes, Ecology, Bob Lober, ORP, Mike Peloquin, WRPS, Mike Connelly, WRPS, Jeff Luke, WRPS, Susan Eberlein, WRPS, Blaine Barton (WRPS), Leela Sasaki (WRPS), Alan Olander (WRPS)

Background:

Consent Decree 08-5085-FVS (State of Washington v. Steven Chu, US Department of Energy) section IV.B.5, requires that "When DOE completes retrieval of waste from a tank covered by this Decree, DOE will submit to Ecology a written certification that DOE has completed retrieval of that tank." (page 7) The details of this written certification have not previously been defined.

Topics discussed:

- Mike Peloquin handed out a further revised draft of the Practicality Evaluation to Forego a Third Technology, with some comments included (Attachment A).
- Mike Peloquin also handed out a page that showed a draft example of part of section 4.1 of the Practicability Evaluation (Attachment B). This example was in response to a question regarding the source of information to be used to identify candidate technologies.
- The candidate technologies should include those identified in the Hard Heel Waste Retrieval Technology Review and Roadmap (RPP-RPT-44139). It was noted that this RPP-RPT-44139 has been updated as new technologies are identified, and will continue to be updated in the future.
- Several clarifying details for the Practicability Evaluation outline were discussed and captured in a final version of the outline (Attachment C).
- Mike Peloquin asked if there was concurrence on the Practicability Evaluation outline with the final changes that had been discussed. Jeff Lyon, Nancy Uziemblo, Mike Barnes and Bob Lober concurred.
- Blaine Barton discussed the planned approach for evaluating the residual waste volume in tank C-108 at the end of the caustic cleaning process.
- The Single-Shell Tank Component Closure Data Quality Objectives (DQO - RPP-23403) contains two approved approaches for measuring final residual volume post-retrieval – the video-camera/CAD modeling system (CCMS) method and liquid volume displacement methods.

WMA-C

- Volume displacement methods are faster than the CCMS method, and in most cases should be more accurate.
- The final liquid volume at the end of the second retrieval technology in tank C-108 may not be sufficient to cover all residual piles of waste. Therefore liquid volume displacement must be supplemented by a method to estimate the volume of any protruding waste piles.
- Ecology indicated that a method that combined volume displacement with some other method for protruding waste piles may be acceptable for the Certification or Practicability Evaluation. However, the final volume estimate for the Retrieval Data Report needs to be performed by one of the methods approved in the DQO, unless the DQO is revised to incorporate alternative methods.
- There was discussion of revising the DQO to include an additional volume estimating method. It was deemed unlikely that the DQO could be revised before completion of C-108 caustic cleaning. However, an action was taken to initiate a DQO revision process, to include Ecology, ORP and WRPS.
- It was noted that if a previously approved method is required for C-108, the CCMS method will be available in the longer term. If necessary, it could be applied prior to completing the Retrieval Data Report.
- Mike Barnes noted that the tank Sampling and Analysis Plan for C-108 should also be revised to take advantage of information gathered during sampling after bulk retrieval.
- Additional technical discussions occurred on the details of volume estimation and the waste configuration in C-108.
- No specific time was set for the next meeting.

Actions:

- Initiate the process to revise the Single-Shell Tank Component Closure Data Quality Objectives (RPP-23403) and the tank Sampling and Analysis Plan for C-108. (Eberlein)

Concurrence:

CJK for Bob Lober 3-13-12

Bob Lober, ORP Date

3-13-12

Jeff Lyon, Ecology Date

Attachment A.

PRACTICABILITY EVALUATION REQUEST TO FOREGO A THIRD RETRIEVAL TECHNOLOGY

Pursuant to Consent Decree 08-5085-FVS
(State of Washington v. Steven Chu, US Department of Energy)

NOTE: Discussions with DOE-ORP, TOC and Ecology have resulted in this outline. This document may change based on new information or improvements. Any of the parties may request changes to this document, in which case they will jointly revise the document.

1.0 INTRODUCTION

2.0 ~~SUMMARY OF TECHNOLOGIES DEPLOYED~~LIMIT OF RETRIEVAL TECHNOLOGY ~~DEMONSTRATION~~

Comment [NU1]: I know we talked about the 'legal' meaning of demonstration here, but I don't want anyone to think we are in the 'demonstration mode' on this activity. Can we use ' validation'? Deleted word MGP

"Limits of technology" (LOT) means that the recovery rate of that retrieval technology for that tank is, or has become, limited to such an extent that it extends the retrieval duration to the point at which continued operation of the retrieval technology is not practicable, with the consideration of practicability to include matters such as risk reduction, facilitating tank closures, costs, the potential for exacerbating leaks, worker safety, and the overall impact on the tank waste retrieval and treatment mission."

2.1 First Retrieval Technology Discussion

Provide a summary of the listed information and refer to tank waste retrieval work plan (TWRWP), as applicable.

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a. Summary of how LOT criteria were met

b. Summary of Selected Retrieval Performance Results – How well it performed

~~a.~~c. Performance graphic similar to attached as applicable to specific retrieval technology~~Includes Performance Graphic~~

2.2 Second Retrieval Technology Discussion

~~Includes Performance Graphic~~Same as 2.1, as appropriate

3.0 SUMMARY OF VOLUME AND DESCRIPTION OF RESIDUAL WASTE

3.1 -Estimate of waste volume removed
3.2 Estimate of residual waste volume remaining
3.3 Description of residual waste remaining

a. -Physical description with photos

~~a.~~b. Description ~~for~~ of the basis for ~~of~~ the estimated inventory, and any limitations on the estimate

~~b. Best Basis Inventory (BBI) Inventory estimate~~

4.0 ~~EVALUATION~~ IMPRACTICABILITY OF ~~3rd~~ THIRD RETRIEVAL TECHNOLOGY ~~FOR WASTE RETRIEVAL~~

4.1 Rationale for ~~3rd~~ third retrieval technology selection
Includes table of available technologies

~~4.1~~4.2 Process description overview

~~4.2~~4.3 Performance assumptions – Include an estimate of how much additional waste each candidate technology could retrieve, based on waste form/configuration at end of second retrieval technology

~~4.3~~4.4 Estimated volume and inventory reduction. Develop table of key constituents and estimated inventory reduction of third retrieval technology: ^{99}Tc, ^{90}Sr, ^{137}Cs, Total Uranium, Actinides, Cr, Nitrates

Comment [NU2]: Consider that this table of technologies includes status of their immediate usage. Where will this table come from—recent research, published roadmap, and/or other? Example attached MGP

5.0 EVALUATION OF PRACTICABILITY

The evaluation of practicability will address, at minimum, Criteria 5.1, 5.2, and 5.3. Other criteria may be included as appropriate. ~~DOE and Ecology agree that t~~The estimated inventories used in this document will be from the most recent Tank Waste Information System (TWINS) Best Basis Inventory (BBI) database.~~,~~ ~~H~~However, this information may be modified to estimate the volume/mass and inventory of key constituents in a specific tank after the deployment of the second retrieval technology for the comparisons performed in this document. Modification and basis for changes will be documented.

~~4.4~~5.1 Inventory Risk Reduction Evaluation (Based on achieving ~~<(?)~~less than 360 cubic feet residual waste)

a. The key constituents of concern that will be estimated and evaluated are: ^{99}Tc, ^{90}Sr, ^{137}Cs,~~,~~ Total Uranium, Actinides, Cr, Nitrates
b. ~~An update to the tank specific BBI~~An estimate of the residual inventory will be made using the estimated volume remaining in the tank following the deployment of the ~~2nd~~ second retrieval technology
c. Provide basis for inventory estimates for each retrieval technology and prepare two tables
   i. Table 1 provides the estimated inventory of the key constituents for the following
      1. BBI estimate at the start of retrieval
      2. ~~BBI e~~Inventory ~~e~~Estimate and basis at the end of first retrieval technology, if applicable
      3. ~~BBI e~~Inventory ~~e~~Estimate and basis at the end of second retrieval~~2nd~~ technology
      4. Inventory ~~e~~Estimate ~~of inventory~~ and basis at the end of ~~3rd~~ third retrieval technology that takes the volume down to 360 cubic feet~~ft³~~
   ii. Table 2 provides the estimated inventory removed for
      1. Deployment of first retrieval technology (if applicable)
      2. Deployment of second retrieval technology

Comment [mgp3]: Inserted words less than

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Comment [h4]: We agreed not to update BBI.

3. An estimate of what would be removed if a ~~3rd~~-third retrieval technology is deployed to reach 360 cubic feet~~ft^3~~
4. Total inventory of key constituents removed if waste residuals ~~retrieval~~ reach~~es~~ 360 cubic feet~~ft^3~~

d. Compare the estimated inventory of waste removed by the ~~3rd~~-third retrieval technology (Assumes the third retrieval~~3rd~~ ~~Technology~~ technology is able to reduce the volume of waste in the tank to at least 360 cubic feet~~ft^3~~) and the waste remaining in the tank after the third retrieval~~3rd~~ technology to the following:
   i. Maximum inventory found in retrieved tanks that have a retrieval data report (RDR)
   ii. Sum of inventory found in retrieved tanks that have a retrieval data report (RDR)
   iii. Estimate of total inventory remaining in tank residuals at the end of retrieval of the waste management area (WMA) from the latest Hanford Tank Waste Operations Simulator (HTWOS) run used to support the River Protection Project S~~s~~ystem P~~p~~lan (~~i.e.g.~~ ORP-11242 Rev.~~EV~~ 6) with the appropriate caveats because HTWOS has not taken into account the caustic dissolution or deployment of ~~2nd~~-second and ~~3rd~~-third retrieval technologies with their residual waste inventory estimates.
   iv. Estimate of total inventory leaked to the vadose zone in WMA C (RPP-RPT-42294, Rev. 1, Hanford Waste Management Area C Soil Contamination Inventory Estimates)

e. For each candidate retrieval technology, note any differences between the end state of 360 cubic feet, and the end state that ~~a~~ the retrieval technology could realistically expect to achieve (see 4.3 above)

~~4.5~~5.2 Evaluation of impacts to worker safety from third retrieval~~3rd~~ technology

a. Qualitative estimate and basis of worker exposure for the tank retrieval up to the time the process was halted.
b. Estimate the exposure due to the selected third retrieval technology and compare to the total exposure estimate. Provide a qualitative evaluation for the estimate basis.
c. Qualitative estimate and basis of the predicted industrial lost time and recordable accidents associated with deploying a third retrieval technology.
d. Other applicable qualitative comparisons based on retrieval technology selected.

~~4.6~~5.3 Evaluation of Mission Impact from deploying third retrieval~~3rd~~ Technology — This criterion assesses the potential for the alternative to impact the waste treatment plant (WTP), impact overall schedule and impact to continuing retrieval of other tanks or other mission priorities. Both Consent Decree and longer term mission impacts will be addressed. This criterion does not require additional model runs (e.g. HTWOS model), but will address mission impacts qualitatively. This may include any of the following:

a. Schedule impacts to other tank retrievals from deploying third retrieval technology
b. Impacts to achieving consent decree milestones
c. Impacts to WTP (e.g. Qualitative impacts from Na and Al based on current information)
d. Other impacts to mission
e. Estimated schedule for the third retrieval~~3rd~~ technology —Total duration for installing, operating, and demobilizing of the particular retrieval technology and includes the confidence for achieving the scheduled end date.
f. ~~Ease of~~ Implementation issues for the third retrieval ~~3rd~~ technology —This criterion refers to the level of difficulty that each alternative may include when installing, operating, and demobilizing equipment, instruments, etc. It also includes the level of project and technical risk associated with implementation.

Comment [NU5]: How will you measure ease? Qualitative discussion. May or may not be included in a practicability evaluation on a case by case basis. Revised wording. MGP

~~4.7~~5.4 Evaluation of potential for exacerbating leaks.

~~4.8~~5.5 Rough order of magnitude cost estimate for deploying third retrieval technology - Total cost for installing, operating, and demobilizing the particular retrieval technology and includes confidence for completing within the indicated estimate

5.6 Evaluation for facilitating tank closures

~~4.9~~5.7 Other, as appropriate

~~5.0~~6.0 ADDITIONAL INFORMATION – as applicable

~~6.0~~7.0 CONCLUSIONS

Attachment B: Draft Example of Table of Candidate Retrieval Technologies

4.0 IMPRACTICABILITY OF THIRD RETRIEVAL TECHNOLOGY

4.1 Rationale for Third Retrieval Technology Selection

The candidate technologies for hard heel waste retrieval were reviewed and documented in *Hard Heel Waste Retrieval Technology Review and Roadmap*, RPP-RPT-44139. The lists of potential technologies were developed based on three categories of tanks and waste:

1. Sound tanks vs. assumed leaking tank
2. Sludge waste vs. saltcake waste
3. Tanks with limited vs. extensive in-tank congestion (e.g. air-lift circulators)

Tank C-108 is a sound tank with residual sludge waste. There is limited in-tank congestion. The candidate technologies for hard heel waste retrieval for sound tanks with limited in-tank congestion, containing sludge waste, are shown in Table 4.1. Limitations, capabilities and gaps associated with each technology are also shown.

Candidate Technology	Limitations/Capabilities	Technology Gaps
Chemical dissolution – water dissolution	Water dissolution applies when water soluble chemicals exist – limited applicability in sludge	Technology available to deploy
Chemical dissolution – caustic cleaning	Caustic cleaning applies when residual waste forms will react with caustic to form soluble or removal chemical forms	Technology available to deploy
Enhanced modified sluicing – telescoping sluicers and/or articulating sluicers	Potential greater reach and ability to avoid in-tank obstructions	An articulating and telescoping sluicer capable of deployment through a 12-inch riser has been developed and tested, but not yet deployed.
Enhanced modified sluicing – used with in-tank vehicle such as a FoldTrack	Can move loose residuals to central location, deployment riser availability could be a limitation	An updated FoldTrack has been developed and tested, but not yet deployed.
MARS – sluice mode	Requires a 47-inch central riser for deployment	Being re-designed for 42-inch riser deployment - installation of new risers in a tank is also an option.
MARS – vacuum mode	Requires a 47-inch central riser for deployment	Still in the development and testing process
Modified sluicing	Limited ability to mobilize hard to remove heel with large pieces	Technology available to deploy

Attachment C: Final Version

PRACTICABILITY EVALUATION REQUEST TO FOREGO A THIRD RETRIEVAL TECHNOLOGY

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5. For each candidate retrieval technology, note any differences between the end state of 360 cubic feet, and the end state that the retrieval technology could realistically expect to achieve (see 4.3 above)

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a. Qualitative estimate and basis of worker exposure for the tank retrieval up to the time the process was halted.
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f. Implementation issues for the third retrieval technology —This criterion refers to the level of difficulty that each alternative may include when installing, operating, and demobilizing equipment, instruments, etc. It also includes the level of project and technical risk associated with implementation.

5.4 Evaluation of potential for exacerbating leaks.

5.5 Rough order of magnitude cost estimate for deploying third retrieval technology - Total cost for installing, operating, and demobilizing the particular retrieval technology and includes confidence for completing within the indicated estimate

5.6 Evaluation for facilitating tank closures

5.7 Other, as appropriate

6.0 ADDITIONAL INFORMATION – as applicable

7.0 CONCLUSIONS

1.0 EVALUATION OF THE OVERALL IMPACT ON TANK WASTE RETRIEVALS

For this example, it is assumed that the first two technologies deployed were bulk retrieval and caustic dissolution, and the results are extrapolated from those currently available from the in-process retrieval of C-108. For this example, it is assumed that the residual volume at the end of second technology deployment was 100 ft^3 above the Consent Decree 08-5085-FVS (State of Washington v. Steven Chu, US Department of Energy) goal of 360 ft^3 following caustic dissolution; and the third technology would be required to remove at a minimum another 100 ft^3 to bring the total volume remaining in the tank to under the Consent Decree goal of 360 ft^3.

1.1 Evaluation of Practicability

The constituents of concern (COC) included in the Evaluation of Practicability can be divided into two groups. The first group contains constituents that could impact groundwater, while the second group contains radionuclides that if brought to surface could provide significant radiological dose to the individuals that brought them to the surface. Previous analyses for tank residuals (retrieval data reports C-103, C-106, and C-200s) have shown these to be Tc-99, nitrate, nitrite, chromium, and uranium for groundwater group; and Sr-90, Cs-137, and the actinides for radiological dose. In addition to the previous analyses for the groundwater group, comparison against WAC-173-340-747 Model Toxics Control Act *Soil Concentrations Protective of Groundwater* for non-radiological constituents for past tank residuals (RPP-RPT-42294 *Hanford Waste Management Area C Soil Contamination Inventory Estimates* Table pD1/D2)[1] has also shown that uranium, nitrite, chromium (conservatively assumed to be hexavalent) and nitrate to have the greatest impact on groundwater.

1.1.1 Inventory Reduction Evaluation

Following each retrieval technology, an estimate of the volume of material remaining in the tank along with its mass/activity will be made. The basis for that estimate will be provided. It should be noted that there could be several methodologies used for this estimate with each providing a different value. However, for the **purposes of this example**, the inventory following caustic dissolution **assumed that the volume of residual waste remaining in the tank will be 460 ft^3** and the inventory of constituents of concern is reduced linearly (this is a made-up estimate for the purposes of this example and does not reflect current operations). [**N.B. for this example, I used just a simple linear reduction based on the volume going to 460 ft^3 during caustic dissolution and 360 ft^3 for the third technology. This simple linear reduction is probably not appropriate for all analytes (e.g., Sr-90 and Uranium). Other scaling methods will be evaluated on a case by case basis**]. Table 1 provides the estimated volumes/ inventory remaining in the tank after each retrieval technology. Figure 1 is a series of pie charts showing the inventory remaining in the tank after each retrieval technology has been deployed. All radionuclides have been decayed to 1/1/2008.

The source for starting inventory estimates is FY04 Q3 Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 8-10-04. The source for the inventory

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[1] Please note the table on this page uses Cr^{+III} not Cr^{+VI}. If Cr^{+VI} is used the soil concentration protective of groundwater is 18.4 µg/g not 2000 µg/g.

numbers following bulk retrieval is the current Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 02-07-2012.

Table 1. Volume/Inventory of COCs remaining in Tank C-108 at the end of each retrieval technology.

Parameter	Units	Inventory at Start of Retrieval	Inventory After Bulk Retrieval	Estimated Inventory after Caustic Dissolution	Estimated Inventory after 3rd Technology
		BBI[1]	SST DQO Sample[2]	Linear Extrapolation	
Contaminants Related to Groundwater Impacts					
Volume	ft^3	8,836	907	460	360
Volume	gal	66,100	6,789	3,441	2,693
Volume	kL	250.2	25.7	13	10.2
Tc-99	Ci	5.61	0.25	0.13	0.10
Nitrate	kg	16,100	358	181	142
Nitrite	kg	8,920	308	156	122
Chromium	kg	226	4.15	2	1.65
Uranium	kg	156	50.4	26	20.0
Contaminants Related to Radiological Dose					
Sr-90	Ci	7,270	6,280	3,183	2491
Cs-137	Ci	70,900	448	227	178
Actinides	Ci	14.6	1.0	0.51	0.4

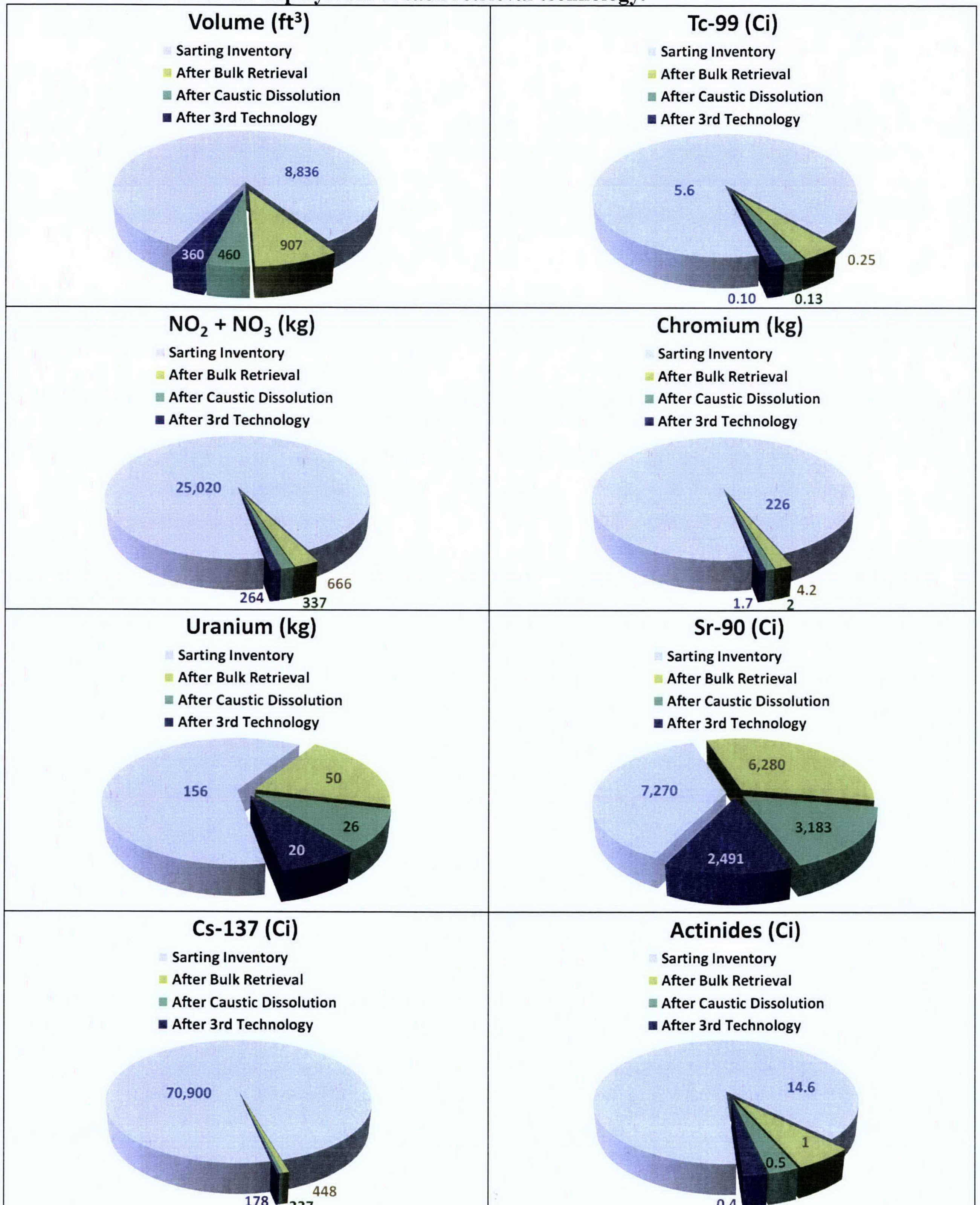
Indicates Linear Extrapolation is not appropriate

[1] FY04 Q3 Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 8-10-04

[2] Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 02-07-2012 (sample data)

Example/Draft using Data from C-108 along with made-up data

Figure 1. Pie Charts showing volume and inventory of Constituents of Concern remaining in the tank after the deployment of each retrieval technology.



N.B. A linear extrapolation for was used to estimate the amount of material removed for the caustic dissolution and 3rd technology. From the results given for bulk retrieval, it appears that this extrapolation underpredicts retrieval of Tc-99, Nitrate, Nitrite, Cs-137 , but overpredicts Uranium or Sr-90.

Tables 2 and Figure 2 provide the volume/inventory of constituents removed for each retrieval technology. Table 2 shows the total volume/inventory removed if the tank is retrieved to at least 360 ft^3. Figure 2 is a series of pie charts showing the inventory removed for each technology. Each pie slice shows the inventory removed for the retrieval technology.

Bulk retrieval used inventory estimates based on sampling after retrieval, while the other technologies show assumed inventory retrieval values based on linear extrapolation. In this example, an assumption has been made about the remaining volume (460 ft^3) after deployment of the second technology. In an actual application, the remaining volume after the second technology will be known. In this example and **in actual cases**, the evaluation will be done with the assumption that the **third technology achieves the Consent Decree goal of 360 ft^3**. As shown in the table, the third technology would remove 100 ft^3 or 1.1 percent of the volume before any retrieval operations has taken place, assuming the third technology was able meet the Consent Decree goal of 360 ft^3.

Table 2. Volume/Inventory of COCs removed from Tank C-108 at the end of each retrieval technology.

Parameter	Units	Inventory at Start of Retrieval	Inventory Removed during Bulk Retrieval	Estimated Inventory Removed during Caustic Dissolution	Estimated Inventory Removed during Third Technology	Total Removed
		BBI[1]	SST DQO Sample[2]	Linear Extrapolation		
Contaminants Related to Groundwater Impacts						
Volume	ft^3	8,836	7,928	447	100	8,475
Volume	gal	66,100	59,311	3,348	748	63,407
Volume	kL	250.2	224.5	12.7	2.83	240
Tc-99	Ci	5.61	5.36	0.12	0.028	5.51
Nitrate	kg	16,100	15,742	177	39	15,958
Nitrite	kg	8,920	8,612	152	34	8,797
Chromium	kg	226	222	2.0	0.46	224
Uranium	kg	156	106	24.5	5.55	136
Contaminants Related to Radiological Dose						
Sr-90	Ci	7,270	990	3,097	692	4,779
Cs-137	Ci	70,900	70,452	221	49	70,722
Actinides	Ci	14.6	13.6	0.5	0.1	14.2

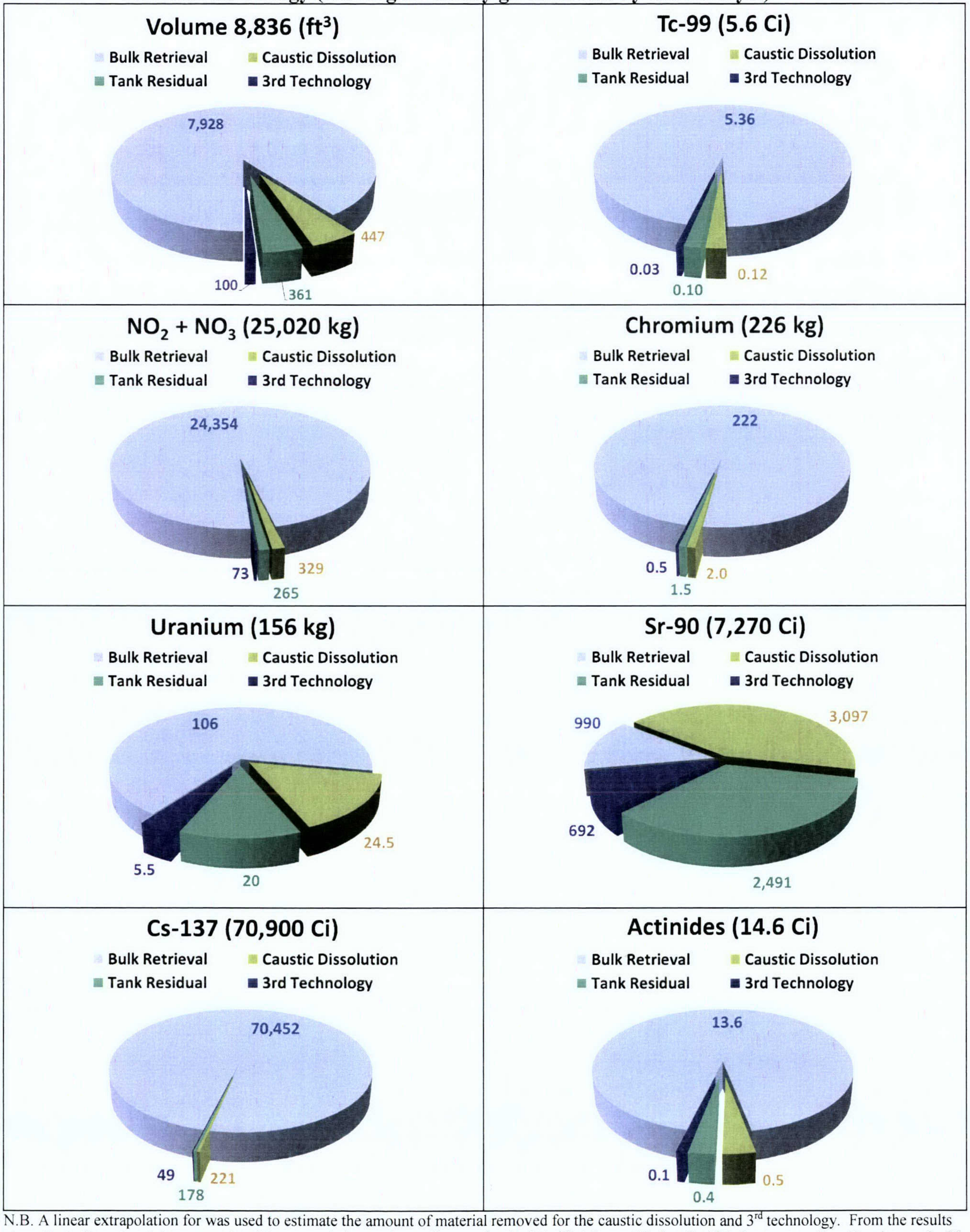
Indicates Linear Extrapolation is not appropriate

[1] FY04 Q3 Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 8-10-04

[2] Best Basis Inventory Calculation Detail report; SST Primary Analytes downloaded from TWINS 02-07-2012 (sample data)

Based on bulk retrieval to date, most of the constituents of concern for bulk retrieval were reduced in quantity by a factor greater than what a simple linear interpolation would predict. For example, although bulk retrieval removed 89.7 % of the volume, Tc-99, Cs-137, and the actinides were removed to 95.5%, 99.4%, and 93.1 of their original mass. However, this is not the case for uranium and Sr-90. A linear extrapolation was used to estimate the activity that would be reduced for deployment of caustic dissolution to reduce the volume to 460 ft^3 and a third technology to reduce the volume to 360 ft^3. The linear extrapolation appears to be a conservative estimate (i.e. it underpredicts the actual inventory removed) for the radionuclides, with the exception of uranium and strontium.

Figure 2. Pie Charts Showing volume and inventory of Constituents of Concern removed by each retrieval technology (starting inventory given in title by each analyte)



N.B. A linear extrapolation for was used to estimate the amount of material removed for the caustic dissolution and 3rd technology. From the results given for bulk retrieval, it appears that this extrapolation underpredicts retrieval of Tc-99, Nitrate, Nitrite, Cs-137 , but overpredicts Uranium or Sr-90.

1.1.2 Comparison of 3rd Technology against Previously Retrieved WMA C Tanks

To date, two 100-series tanks (C-106 and C-103) and all four 200 series tanks have been retrieved in WMA C. Tank C-106, did not meet the Hanford Federal Facility Agreement and Consent Order (HFFACO) (Ecology et al. 1989) retrieval goal of 360 ft^3, it has approximately 370.5 ft^3, while C-103 bettered the HFFACO goal by 20 ft^3 with a residual volume of 340 ft^3. All of the 200 Series tanks met the HFFACO goal of 30 ft^3, with the residual volume ranging from 18.4 ft^3 in C-204 to 19.7 ft^3 in C-202. Table 3a compares the amount of inventory removed using a third technology against the maximum inventory found in the other retrieved tanks in WMA C, while table 3b compares the amount of inventory assumed to be removed using a third technology to get to 360 ft^3 against the sum of the inventory of each constituent for all other retrieved tanks. Following Table 3a-b is Figure 2 which is a series of pie charts showing a comparison of the maximum found between each tank, sum of what is currently left behind in the retrieved tanks and what is expected to be removed from deployment of the third technology.

Table 3a. Comparison of third technology against maximum found in WMA C retrieved Tanks

Parameter	Units	Third Tech. Invent.	Maximum of Residual Inv. (C-106, C-103, C-200s)	
			Max of WMA C Residual Inventory	3rd Tech Inv. / Max Inv.*100 (%)
Contaminants Related to Groundwater Impacts				
Volume	ft^3	100	370	27%
Tc-99	Ci	0.03	0.167	18%
Nitrate	kg	39	>35	111%
Nitrite	kg	34	>41	83%
Chromium	kg	0.46	12	3.8%
Uranium	kg	5.6	326	1.7%
Contaminants Related to Radiological Dose				
Sr-90	Ci	692	60,100	1.2%
Cs-137	Ci	49	1,320	3.7%
Actinides	Ci	0.1	122	0.08%

Table 3b. Comparison of third technology against sum of residuals for WMA C retrieved Tanks

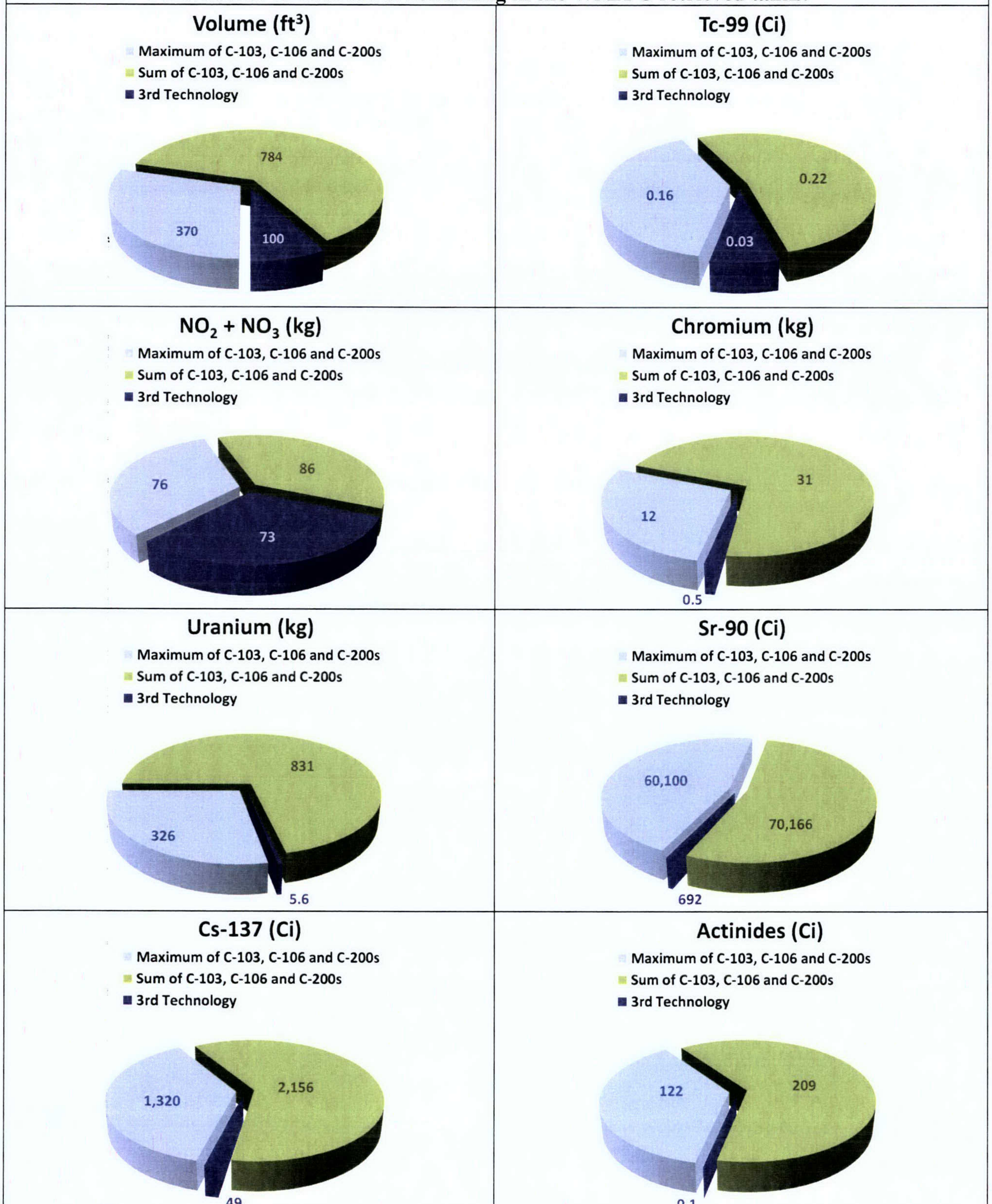
Parameter	Units	Third Tech. Invent.	Sum of Residual Inventory (C-106 + C-103 + C-200s)	
			Sum of WMA C Residual Inventory	3rd Tech Inv. / Residual Inv. * 100 (%)
Contaminants Related to Groundwater Impacts				
Volume	ft^3	100	784	13%
Tc-99	Ci	0.03	0.22	3.7%
Nitrate	kg	39	>42	93%
Nitrite	kg	34	>44	77%
Chromium	kg	0.46	31	1.5%
Uranium	kg	5.6	831	0.67%
Contaminants Related to Radiological Dose				
Sr-90	Ci	692	70,166	1.0%
Cs-137	Ci	49	2,156	2.3%
Actinides	Ci	0.1	209	0.05%

> analytical results indicates less than the detection limit for C-106 which the tank that had the maximum found in all retrieved tank

[Note, I will probably add another section that compares what is expected to be remaining in tank C-108 after retrieval to the Consent Decree 08-5085-FVS (State of Washington v. Steven Chu, US Department of Energy) goal of 360 ft^3 to these same metrics, maximum of all retrieved tanks and sum of all retrieved tanks.]

Example/Draft using Data from C-108 along with made-up data

Figure 3. Pie charts showing volume and inventory of Constituents of Concern removed for the third technology compared against the maximum of and sum of the volume and inventory of Constituents of Concern of remaining in the WMA C retrieved tanks.



N.B. A linear extrapolation for was used to estimate the amount of material removed for the caustic dissolution and 3rd technology. From the results given for bulk retrieval, it appears that this extrapolation underpredicts retrieval of Tc-99, Nitrate, Nitrite, Cs-137 , but overpredicts Uranium or Sr-90.

1.1.3 Facilitating Waste Management Area C Closure

To understand the relative impact of using a 3rd technology to meet the Consent Decree goal of 360 ft^3 on closure, a comparison is made between what is expected to be left in all WMA C tanks at closure and what has already leaked to the vadose zone due to past operations. The expected inventory values in tank residuals come from *River Protection Project System Plan* (ORP-11242 Rev. 6), while the estimates for the vadose zone come from *Hanford Waste Management Area C Soil Contamination Inventory Estimates* (RPP-RPT-42294 Rev. 1). It should be noted that the inventory values from the HTWOS run supporting the system plan did not evaluate caustic dissolution and may not be an appropriate comparison.

Table 4. Residual Volume/Material Removed Per Retrieval Technology

	Units	3rd Technology Removes (at 360 ft^3)	All C Tanks Residual Inv. at Closure		Vadose Zone Inventory at Closure	
			Inventory	3rd Tech Inventory / Tank Residual Inv. * 100 (%)	Inventory	3rd Tech Inventory / Vadose Zone Inv. * 100 (%)
Contaminants Related to Groundwater Impacts						
Tc-99	Ci	0.03	2.39	1.3%	7.82	0.38%
Nitrate	kg	39	2,215	1.8%	31,876	0.12%
Nitrite	kg	34	130	26.2%	9,233	0.37%
Chromium	kg	0.46	158	0.3%	155	0.30%
Uranium	kg	5.55	5,670	0.1%	21.3	26.0%
Contaminants Related to Radiological Dose						
Sr-90	Ci	692	281,500	0.2%	1034	67%
Cs-137	Ci	49	25,490	0.2%	21,402	0.2%
Actinides	Ci	0.11	966	0.01%	13.8	0.8%